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<p>(54) Title: A FISH TAG</p>			
<p>(57) Abstract</p> <p>An intermuscular fish tag and tagging system is provided; the fish tag including an anchor member (40) having a frustoconical head (41), an axial channel (43) running through the head, and two barbs (42) flaring outwardly from the base of the head. The barbs initially run parallel to the axis of the head and then flare outwardly to an angle of forty-five degrees at the end of barb farthest from the head. Each barb has an inside (44) and outside (45) surface which meet at a sharp tapered edge (47), providing greater mass at the end of the barb that meets the head than the end of the barb farthest from the head. Such a configuration allows for resiliency in the barbs, so that they bend going in the fish and return to their original positions once inside the muscle of the fish. An application device (60), having an applicator with a shaft tapered to a sharp point (612) is passed through the axial channel to form a complete cone with the head of the anchor member to puncture the fish.</p>			

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+ DESIGNATIONS OF "SU"

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INTERNATIONAL SEARCH REPORT

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I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) ⁶

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II. FIELDS SEARCHED

Minimum Documentation Searched ⁷

Classification System	Classification Symbols
U.S.	40/300, 301

Documentation Searched Other than Minimum Documentation
to the Extent that such Documents are Included in the Fields Searched ⁸

III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹

Category ¹⁰	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
Y	US,A, 3,999,478 (TARVER) 03 SEPTEMBER 1968 See Figure 1	1-29
Y	US,A, 1,347,868 (NICHOLS) 27 JULY 1920 See Figure 3	2,3,14-29
Y	US,A, 4,790,090 (SHARBER) 13 DECEMBER 1988 See Figure 2 AND Col. 4, Lines 38-41	11,24
A	US,A, 4,920,670 (AMICK) 01 MAY 1990 See Abstract	11,24

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IV. CERTIFICATION

Date of the Actual Completion of the International Search

01 MARCH 1991

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Signature of Authorized Officer: **MILTON NELSON, JR.**
INTERNATIONAL DIVISION
Milton Nelson Jr.

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A FISH TAG

Field of the Invention

The present invention relates to fish tags, and more particularly to a new and improved fish tagging system which includes a new and improved anchor for securing the fish tag, a mechanism for connecting a streamer to the anchor, and an applicator for inserting the tag in the fish.

Background of the Invention

Tagging of fish is becoming an important conservation effort for commercial and sports fishermen alike, especially due to the worldwide environmental awareness of the 1990's. The data gathered through tagging programs is vital to estimating age, growth, migration patterns, distributions, and stock structures of all species of fish, and most importantly to their ultimate survival.

Each year hundreds of billfish are tagged and released by sportsfishermen, yet only a very small fraction of those tagged are ever recaptured. Many scientists believe that tag shedding may be the major reason for this problem. Such problems as biological incompatibility, faulty tag construction and improper tag application are the major reasons for most tag shedding.

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Tagging of billfish and tuna fish are of particular interest to commercial and sports fisherman, who see the recent decrease in the number of such fish that are caught, especially in the
5 Atlantic ocean. The decrease is caused by the apparent overexploitation of these fish by the combined effort of anglers and commercial fisherman. Billfish is a generic term for fish such as marlin, spearfish, swordfish, and sailfish.

10 The types of existing billfish and tuna tags are few in number. The most common tag is a stainless steel dart attached to a piece of monofilament on which a yellow vinyl streamer is attached. The streamer has printed on it an
15 identification number and a return address to the person or organization sponsoring the tagging program. This dart tag is manufactured by Floy Tag and Manufacturing, Inc. in Washington state and used extensively by the National Marine
20 Fisheries Service in Miami, Florida. The dart is a stainless steel anchor which fits onto a stainless steel applicator protruding about two inches from a six foot wooden pole. The streamer is attached to the stainless steel dart by monofilament line which is inserted through a hole in
25 the metal dart head and crimped through a flush mounted nut which is held by the dart. The streamer is hand pressed into a notch in the wood pole. The tag is inserted into the fish by applying force to the applicator. More
30 specifically, the tag is inserted a full two inches into the flesh of the fish just below the forward part of the dorsal fin in the billfish and the second dorsal fin for tuna. The tag is intended to be inserted completely through the
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petrygiophores, which is the bone structure which anchors the dorsal fin, so that it is locked in place behind the petrygiophores.

Many problems exist with the dart tag, which
5 may have contributed to a low tag recovery rate. The dart is made from metal which is not biologically compatible with the fish. The metal dart often causes infections and irritations that prevent the tag wound from healing properly, which
10 ultimately results in tag loss. The surface area of the tag is small (i.e., a thin blade) which provides less holding capability. The thin dimensions and sharpness of the dart causes a slit type wound as opposed to a puncture type wound when
15 inserted in the flesh. Slit type wounds heal slower than punctures. The slit is instrumental in tag loss since it doesn't heal as fast. The thin stainless steel anchor is also bent slightly near the tip. This bend can hinder penetrating
20 the skin of the fish if attempted at angles less than ninety degrees.

In addition, the applicator and its method of use can cause faulty application of the dart tag, which also can result in tag loss. In particular, requiring that the dart tag be inserted behind the petrygiophores leaves much to chance. If the tag is not properly locked in place behind the petrygiophores the tag could remain on the applicator as it is withdrawn from the fish. Alternatively, it
25 could remain in the fish with nothing to hold on to except the flesh of the fish which may reject it.

The applicator has a stainless steel shaft which is rounded on the end with a slot forming
30 two ears. The dart tag must be bent to properly

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set in the applicator. As a consequence, the dart head faces slightly sideways, and is inserted at an angle in the fish, i.e., off center. An increased amount of force is needed by the user to insert the tag sideways. The side force wears on the ears of the applicator which holds the dart, causing the ears to bend until they eventually break off. Flesh can also be jammed between the ears of the applicator when inserted in the fish thereby preventing the dart head from coming off in the fish, and being withdrawn with the applicator. The flesh, along with dirt that gets caught between the ears from frequent use of the applicator, can also cause the ears to rust and break off.

The notch in the wooden pole or tag stick, which the applicator is connected to, swells, splinters and can fill with dirt, preventing the streamer from staying in the notch. To remedy the swelling problem and to hold the tag secure a rubber band is now used to hold the streamer to the pole.

Additionally, when the streamer is held next to the pole and the dart inserted in the applicator, a loop or bend is formed in the monofilament connecting the streamer to the dart head. The loop or bend in the monofilament causes a side force which can prevent the dart from coming off the applicator, since about one hundred pound test monofilament line is used.

Another problem with the dart tag is the mechanical connection used to secure the streamer to the dart head. The monofilament is usually crimped by a flush mounted nut on the dart head. Monofilament is a polymer which crystallizes and

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becomes brittle when heat is applied to it. With
the prior art tags heat is applied to the monofil-
ament when it is crimped, tied in a knot, or
heated to a bulbous end to connect the streamers
5 to their respective anchor members.

Barnacles and other marine life often grow
onto the streamer and destroy, dissolve or deter-
iorate the address and identifica-tion number on
the streamer. Further, the marine growth can make
10 the streamer look like a parasite worm which
naturally grows onto billfish. This causes the
streamer to be hidden from view, preventing re-
covery of the information contained on the
streamers.

15 Variations of the dart tag described above are
made for different tagging programs. For example,
the Australian tag has a dart for anchoring in the
fish which is tapered for easier insertion. The
Australian tag has an improved streamer connec-
20 tion which uses stainless steel wire instead of
monofilament. The wire is looped through a hole
in the dart and twisted and bonded inside the
streamer. However, the wire can potentially rust
and break off over time, even though it is stain-
25 less steel. The same application system is used
as with the dart tag sold by National Marine
Fisheries Service.

Another tag used for tagging tuna has a nylon
30 anchor member formed in the shape of a cone. The
tuna tag has two barbs which are created by mold-
ing two slots in the cone and heating the sliced
ends to bend them straight away from the base of
the anchor, as opposed to being radiused or flared
out. The problem with the barbs is that they are
35 not resilient enough to retract to their original

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positions after being inserted in the fish, which can result in poor holding capability and ultimately tag loss. Further, the barbs are not tapered to a sharp edge to shear the flesh of the 5 fish to properly secure the tag in the fish. The tuna tag has a cavity in the anchor for inserting an applicator. The applicator has a metal shaft with a rounded head. But the applicator does not pass through the anchor member for puncturing the 10 fish, and the anchor member can fall off the applicator very easily. Also, the nylon anchor tip can be difficult to insert through thick scales.

The streamer on the tuna tag is connected by monofilament to a hole in the top of the conical anchor member. The enlarged part of the nylon anchor that accommodates passage of the monofilament causes resistance when puncturing the fish, also causing tag loss. The monofilament is bulbous on the end connected to the anchor member to prevent the monofilament from falling back. 15 through the hole. The bulbous end is created by heating the monofilament, which crystallizes over time and can break. The other end of the monofilament is passed through the streamer and is 20 sharply bent and covered with a plastic tube. The plastic tube is heat shrunk over the monofilament 25 to prevent it from passing back through the streamer.

For tagging fish, applicators are connected to 30 a tag stick. The tag stock may or may not have some type of stop system to prevent insertion of the tag too far into the fish, or entirely through the fish. Overinsertion is caused by the excitement of tagging large fish, such as billfish. 35

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The tag stick is a pole made from fiberglass, wood or aluminum. The applicator and tag stick, when used with existing tags such as the dart tag and tuna tag, are only used as force applying mechanisms. They do not pass entirely through the anchor member to initially puncture the fish.

5 Also, the applicators as discussed above for the dart type tags and the plastic tuna tag provide poor mechanisms for holding the anchor member on the applicator, which leads to faulty application.

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Summary of the Invention

According to the invention, a fish tag is provided including an anchor member which includes a generally conical head, a rear portion extending from the base of the head, and two barbs flaring outwardly from the base of the conical head. The barbs are at an angle to the axis of the conical head. The angle is larger at the end of the barb which is farthest from the head than at the end of the barb which meets the head. The barbs are flexible for bending inward when inserted in the fish, but resilient enough to bend outward to their original positions once inside the fish.

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20 The barbs are also rigid enough to not be bent outward substantially further than their original positions, in order to secure the anchor firmly inside the fish. Preferably, the anchor member also has an axial channel running through its

25 conical head and rear portion through which an applicator may be inserted for holding the tag, and applying center force to the anchor member in

30 order to puncture the fish to facilitate insertion of the anchor member. The axial channel also facilitates withdrawal of the anchor member once

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the anchor member is inserted inside the fish.
Connected to the anchor member is a streamer.

Also, a new mechanism is provided for connecting
5 a tube carrying indicia of the fish to a hole
in the anchor member. Monofilament having first
and second ends is used to make the connection.
The monofilament is passed through the hole in the
10 anchor member and joined with the second end and
passed through the tube. The monofilament ends
passed though the tube are folded back along the
length of the exterior of the tube. Surrounding
the monofilament ends and the tube is a heat
shrinkable material to prevent the monofilament
ends from coming loose.

15 A new device is also provided for inserting
the tag in the fish. The device includes an applicator
having a shaft, one end of which is
tapered to a sharp point and passes through the
axial channel of an anchor member. The applicator
20 holds the tag and facilitates anchoring the tag
member into the muscle of the fish. The
applicator also facilitates withdrawal after tagging
the fish leaving only the anchor member in the
fish. Means are provided for connecting the other
25 end of the applicator to the first end of a nylon
stop. The nylon stop allows insertion of the
anchor member about two inches into the muscle of
the fish. Further, means are provided for connecting
the nylon stop to a tag insertion pole,
30 which applies force to the applicator to insert
the anchor member in the muscle of the fish.

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Brief Description of the Drawings

Figs. 1A and 1B are a bottom and top perspective view, respectively, of a typical prior art dart tag used for billfish and tuna fish;

5 Fig. 2 is a perspective view of a variation of the prior art dart tag, called the Australian tag, which is used to tag billfish and tuna fish;

10 Fig. 3 is a side perspective view of a typical prior art applicator and tag stick used with the dart tags of Figs. 1A, 1B, and 2;

15 Fig. 4 is a side perspective view of the dart tag of Figs. 1A and 1B connected to the applicator and tag stick of Fig. 3;

Fig. 5 is a perspective view of a prior art plastic tuna tag;

20 Fig. 6 is a perspective view of the anchor member of the fish tag of the present invention;

Fig. 6A is a cross-sectional view along the line 6A-6A of the anchor member of the fish tag of the present invention;

25 Fig. 6B is a cross-sectional view along the line 6B-6B of a barb of the anchor member of the present invention.

Fig. 7 shows a monofilament line placed to connect through a transverse hole in the anchor member (side view);

30 Fig. 7A shows the monofilament ends of Fig. 7 passed through the tube and folded back along the length of the tube;

Fig. 7B is a side view of the mechanical connection used to connect the tube to the anchor member in accordance with the present invention. A heat shrinkable material is placed over the tube and monofilament ends of Fig. 7A;

- 10 -

Fig. 8 is a cross-sectional view of the applicator of the application device of the present invention.

5 Fig. 8A is a side view of the application device for inserting the fish tag in the muscle of the fish in accordance with the present invention;

Fig. 9 is a side view of the fish tag of the present invention mounted to the application device shown in Fig. 8A.

10 Detailed Description of the Invention

Referring now to the drawings, Figs. 1 and 2 illustrate a commercially available dart tag manufactured by Floy Tag and Manufacturing, Inc. in Washington state and extensively used by the

15 National Marine Fisheries Service in Miami, Florida. The dart tag 1 is used for tagging billfish and other large ocean fish. The dart tag 1 includes a dart 2 which acts as an anchor to secure the tag in the petrygiophores of the fish.

20 Attached to the dart is a yellow vinyl streamer 3 which has printed on it indicia 4 of the fish which includes an identification of the fish and the return address of organization running the tagging program. The dart tag is thinly shaped

25 like a razor blade, with sharp edges, having a bottom surface 5, a top surface 6, a bent pointed end 7, a notch end 8, a rectangular hole 9 for connecting the tag to the applicator 20 and tag stick 21 as shown in Figs. 3 and 4, and a circular hole 10 for connecting the streamer 3 to the dart with monofilament 11. The monofilament is inserted through the hole and crimped by a flush mounted nut 12 held on the dart by the metal flange 13. The other end of the monofilament is

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5 passed through the streamer, and bent in half 11a and a heat shrinkable tube 14 is placed over the monofilament to hold it from passing back through the streamer. A gap 14a is formed between the streamer and the heat shrinkable tube which provides heterogeneous surface area for attachment of unwanted marine growth, such as barnacles and the like. Such marine growth also attaches to the indicia of the fish carried by the streamer, such as the identification number and the address, and tends to destroy, deteriorate, erase, or severely degrade the quality of the indicia, over time or upon removal of the growth. Further, the growth tends to hide the streamer from view.

10 15 The dart tag is bent for setting between the ears of the applicator 21 and the streamer is press fit in the notch 23 as shown in Fig. 4. The monofilament forms a loop 24, creating side force. The completed fish tagging system is then used to place the dart through the flesh of the fish past the petrygiophores to lock it in place. However, the metal dart tends to be rejected by the fish, and infections can occur. Also, the small mass and surface area of the dart provide for very little holding capability if the dart breaks free from behind the petrygiophores. Very often the dart fails to be placed between the petrygiophores but remains only in the flesh. The applicator provides side force instead of center force.

20 25 30 35 30 Also, flesh and dirt get caught between the ears, causing the dart to stick to the applicator and corrosion encourages the ears to eventually break off. The crimping of the monofilament heats it causing it to eventually become brittle and break.

35 Fig. 2 shows an another version of the dart

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5 tag, called the Australian tag. The pointed end of the dart has tapered edges 15 to facilitate insertion in the fish. Also, the monofilament is replaced with stainless steel wire 16, which is twisted and bonded inside the streamer 17. The adhesive material used for bonding forms a bulbous end 18 at the end of the streamer connected to the dart.

10 Fig. 5 shows a prior art tag 30 for tagging tuna fish. The tag has a conical anchor member 31 made from nylon. The anchor member 31 has two barbs 32, and a round cavity 33 open only on its back end for insertion of an applicator (not shown), having a blunted end, for insertion of the anchor member in the fish. The barbs are formed by molding slots in the anchor member and then bending them straight out while applying heat. However, after being bent inward when inserted in the fish, the barbs fail to retract to their original positions. The nylon end of the anchor member fails to give much piercing power, especially when the scales of the fish are thick, as is the case with billfish. The streamer 34 is connected to the anchor member by monofilament 35. The monofilament is inserted through a hole 36 on the top of the anchor member and then heated to form a bulbous end 37 to prevent the monofilament from passing back through the hole. The heat causes the monofilament to break down over time, and tag loss results. The other end 38 of the monofilament is secured using a heat shrinkable tube 39.

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35 Fig. 6 shows a perspective view of the anchor member 40 of the present invention. The fish tag is designed as an intermuscular tag which is not

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rejected by the fish. The anchor member 40 has a generally conical head 41, a rear portion 41a, two outside radiused barbs 42, an axial channel 43 extending entirely through the anchor member, and a transverse hole 44. The head is actually frustoconical in shape due to the axial channel. The head of the anchor member provides sufficient surface area to cause a puncture type wound instead of a slit type wound, which expedites the healing process. Also, this configuration provides greater holding capability and facilitates insertion of the anchor member in the fish. The anchor member is preferably used for insertion in the muscle of large pelagic fish, such as billfish. It should be inserted at least two inches into the muscle of the fish to properly secure the anchor member and prevent tag shedding. The tag can be used for smaller fish if the anchor member is proportionately reduced in size.

The anchor member is made of nylon 66, such a ZYTEL 132F and ZYTEL 101L to prevent rejection by the fish. The nylon used is a food grade nylon. ZYTEL is a trademark of the DuPont Company.

The anchor member is preferably injection molded in order to form the two barbs which flare outwardly from the base of the conical head. The barbs are radiused during the molding process with respect to the axis of the conical head. Fig. 6A shows that the angle between the barb and the axial of the conical head is larger at the end of the barb farthest from the conical head than at the end of the barb which meets the head. More specifically, the barbs run parallel to the axis of the head at the end of the barb which meets the head, and the end of the barb farthest from the

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head is at an angle of about forty-five degrees or greater to the axis of the head. Preferably, the angle is about forty-five degrees. Both the outside surface 45 and inside surface 46 of each barb 5 is radiused away from the axis of the anchor member. The outside and inside surfaces meet at a sharp tapered edge 47. The edge shears the muscle of the fish to secure the fish tag by preventing it from backing out. Further, the distance between the outside and inside surfaces is greater at 10 the end of the barb that meets the head than at the end of the barb farthest from the head. Thus, the barbs have greater mass at the end of the barb that meets the head than at the end of the barb 15 farthest from the head. The barbs are flexible enough to bend inward to allow easy insertion into the muscle of the fish. However, the barbs are also resilient enough (i.e., resistant or spring loaded) to bend outward to their original 20 positions once in the muscle of the fish. Further, the barbs are rigid in preventing bending outward substantially farther than the original positions. This secures the anchor member firmly 25 inside the fish. Additionally, the outside surfaces of the barbs are curved 48 to follow the curvature of the circular base of the conical head, as shown in Figs. 6 and 6B. The barbs are wide, the ends of the barbs which meet the conical head extending over about 75% of the circumference 30 of the circular base of the conical head. The barbs, when compressed on insertion, preferably form a near cylinder with the rear portion which extends from the base of the head. The cylinder formed has the same diameter as the base of the 35 conical head.

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The axial channel 43 running through the conical head and the rear portion of anchor member is used for insertion of an applicator, preferably the sharp stainless steel one shown in Fig. 8.

5 The applicator and the generally frustoconical head of the anchor member, in combination, form a complete cone. The applicator is used to hold the fish tag, to apply center force to the anchor member, and to puncture the exterior surface and muscle of the fish to facilitate insertion of the anchor member. The axial channel also facilitates withdrawal of the applicator once the anchor member has been inserted in the muscle of the fish and provides greater holding capability. Therefore,

10 15 this tag system uses its resilient barbs, nylon material, frustoconical shape and stainless steel applicator for easier penetration into the muscle of the fish, withdrawal of the applicator leaving the anchor member in the fish, and better holding capability for better tag performance than those tags presently available.

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Figs. 7, 7A, and 7B illustrate the fish tag of the present invention with a new and improved mechanism for mechanically connecting a flexible streamer tube carrying indicia of the fish to the anchor member 50 of the fish tag. This mechanism is not limited to the anchor member 50 of the invention described herein. The attachment of the anchor member to the streamer is done mechanically using monofilament and shrink tubing. No glue, direct heat to the monofilament, or caustic chemical is used. The anchor member must have a hole 52, which may be transverse as shown. The first end of monofilament 51, having first and second ends, is passed through the transverse hole

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5 52 of the anchor member as shown in Fig. 7 and joined with the second end. The two ends are passed through the tube and folded back along the length of the exterior of the tube 53 as shown in Fig. 7A. The mono-filament ends should be folded against the loop 54 formed by the monofilament which does not pass into the streamer and which is connected to the hole in the anchor member. One function of the loop 54 is to provide more surface area for holding the tag in the fish. As shown in Fig. 7B a heat shrinkable material, preferably plastic, such as a plastic tube, surrounds the tube and the monofilament ends to prevent the first and second ends from coming loose. The heat shrinkable material is also used to protect the indicia of the fish carried by the tube, which is either printed, written, or colored material, from being hidden, destroyed or deteriorated by marine growth. Preferably the heat shrinkable material
10 is transparent so that the indicia can still be viewed without having to remove the material from the tube. This mechanism does not crimp, tie, apply heat or glue to the monofilament in any way that would be sufficient to cause it to crystal-
15 lize and break apart, causing loss of the indicia carrying tube.
20 The streamer is preferably a fluorescent orange color so that the tag can more easily be seen on the fish, especially if marine life has attached to it.
25 A method of making the mechanical connection of the streamer tube has also been discovered which follows the order shown in Figs. 7, 7A, and 7B. The method includes inserting the monofilament through the hole in the anchor member, preferably,

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so that one half of the monofilament goes through the hole leaving monofilament ends on both sides of the hole with approximately equal lengths.

5 Then, joining the ends together and inserting the ends through the axial channel of the tube, preferably a flexible tube carrying indicia of the fish. Preferably the monofilament ends are inserted so that they exceed the end of the tube by at least the length of the tube, and so that a portion of the monofilament never goes through the tube. The portion of monofilament, not going through the tube, forms a loop 55 between the hole in the anchor member and the closest or nearest end of the tube. Next, the monofilament ends are

10 folded back along the length of the tube and preferably along a portion of the monofilament loop. Finally the tube and monofilament ends are surrounded with a heat shrinkable material, preferably a plastic tube, which is shrunk in place by applying heat to the plastic tube to complete

15 the mechanical connection.

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An improved application device and system has also been provided in accordance with the present invention, for inserting the anchor member into a fish. Fig. 8 shows a cross section of the applicator 60, which is preferably a stainless steel shaft, having a first end 61 which is tapered to a point 61a. A second end 62 of the applicator has a diameter which is slightly larger than the first end so that the anchor member of the fish tag can be positioned at the point where the two ends meet and held on the first end of the applicator. Fig. 8A shows the completed application device 63, which includes in combination the applicator 60, a stop system such as a nylon

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stop 64, and a tag insertion shaft called a tag stick in the art. The second end 62 is connected to the first end of the nylon stop 64a. The first end of the nylon stop has a set screw (not shown) mounted inside into which the second end 62 of the applicator is inserted and mates. The second end of the applicator may alternatively be secured by epoxy adhesive or any other means known in the art. The nylon stop is preferably a machined piece of nylon, such as delrin a trademark of the Du Pont Company, which is about one inch in diameter. The applicator must be inserted into the nylon stop so that the second end of the applicator shaft is exterior to the nylon stop by at least one inch to assure that the anchor member goes at least two inches deep into the muscle of the fish. Alternatively, the second end can be threaded so that it will fit into the prior art aluminum tag sticks. The second end 64b of the nylon stop has an axial cavity(not shown) into which a tag stick 65, preferably a fiberglass pole, is inserted. The tag stick is preferably secured in the nylon stop by epoxy adhesive or any other means known in the art. In addition, the tag stick should be about six feet in length for easier application of the tag into the fish from the boat, without removing the fish from the water. The nylon stop also has a notch 66 in to which the streamer is press fit.

The application device is used to insert the fish tag in to the fish; more specifically, to insert the intermuscular anchor member of the fish tag two inches into the muscle of the fish, to prevent tag shedding. Fig. 9 shows the completed application system of the present invention. As

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shown, the anchor member is mounted on to the first end 61 of the applicator shaft and positioned at the point where the first and second ends meet 61b. The first end 61 of the applicator shaft is passed through the axial channel of the anchor member. The applicator's first end must be passed through the axial channel so that the frustoconical head of the anchor member forms a complete cone in combination with the first end of the applicator. The streamer is then press fit into the notch 66 of the stop system. The application system has been designed for easy penetration and requires only minimum force to insert it to the proper depth in the fish. However, the application system can be reduced in size proportionately for smaller fish. Thus, the anchor member and applicator would be reduced so that they can be inserted into the muscle of smaller fish.

For example, the applicator 60 is about four inches in length; the first end 61 having a length of about one and one-eighth inches. The second end 62 of the applicator is mounted into the nylon stop so that one inch protrudes from the exterior to allow the anchor member 40 to be inserted two inches into the muscle of the fish. The anchor member 40 has a total length of 0.907 inches. The barbs 42 are at a forty-five degree angle from the axis of the conical head 41. The end of the barb that meets the conical head 41 is 0.422 inches from the front of the conical head 41. The tapered edge of the barb 47 is 0.720 inches from the front of the conical head. The diameter of the axial channel is 0.098 inches. The diameter of the base of the conical head is

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0.312 inches. As dimensioned, the applicator when inserted through the axial channel of the anchor member forms a complete cone.

5 In operation for billfish tagging, the fish is usually held at a suitable tagging position alongside the boat by holding the leader over the side at the forward end of the cockpit while idling the boat slowly ahead. The fish should not be handled or removed from the water. The application device is then used to insert the anchor member of the fish tag into the fish until the stop assembly is pressed against the fish, assuring that the anchor member is inserted the required two inches into the fish. Preferably, the target is the middle shoulder, well above the lateral line away from the head, gills, gill plates, and other vital organs of the fish.

10 15

20 While in the foregoing there has been described and shown a preferred embodiment of the invention, various modifications and equivalents may be resorted to within the spirit and scope of the invention as set forth in the following claims.

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What Is Claimed Is:

1. An intermuscular fish tag comprising:
 - (a) an anchor member having a generally conical head, a rear portion extending from the base of the head, and at least two barbs flaring outwardly from the base of the conical head,
the barbs being at an angle to the axis of the conical head which is larger at an end of the barb farthest from the head than at an end of the barb which meets the head,
the barbs being flexible enough to bend inward to allow easy insertion of the anchor member in the muscle of the fish, resilient enough to bend outward to their original positions once in the muscle of the fish but rigid in preventing bending outward substantially further than the original position in order to secure the anchor member firmly inside the fish, and
(b) a streamer connected to the anchor member.
2. The intermuscular fish tag of claim 1, wherein the head of the anchor member is frustoconical.
3. The intermuscular fish tag of claim 1, wherein the head of the anchor member has sufficient surface area to cause a puncture wound rather than a slit type wound during insertion in the fish to expedite the healing process.
4. The intermuscular fish tag of claim 1, wherein the barbs have outside surfaces generally curved

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to follow the curvature of the circular base of
the conical head.

- 5 5. The intermuscular fish tag of claim 1, wherein
 the barbs run parallel to the axis of the head at
 the end of the barb which meets the head, and the
 end of the barb farthest from the head is at an
 angle of about forty five degrees or greater to
 the axis of the head.
- 10 6. The intermuscular fish tag of claim 1, wherein
 the barbs have an outside surface which is
 radiused away from the axis of the anchor member,
 the barbs also having an inside surface which is
 radiused away from the axis of the anchor member,
 the outside and inside surfaces meeting at a
 tapered edge, wherein the distance between the
 outside and inside surfaces is greater at the end
 of the barb which meets the head than at the end
 of the barb farthest from the head so that the
 barb is flexible bending inward and resilient
 enough to bend outward to its original position
 once inside the fish, and rigid enough to prevent
 bending outward substantially further than the
 original positions in order to secure the anchor
 member firmly inside the fish.
- 15 20 7. The intermuscular fish tag of claim 7, wherein
 the barbs have greater mass at the end which meets
 the head than at the end farthest from the head.
- 25 30 8. The intermuscular fish tag of claim 1, wherein
 the barbs have a sharp edge for shearing the
 muscle of the fish to secure the fish tag in the
 fish.

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9. The intermuscular fish tag of claim 1, wherein the anchor member is made from nylon 66.
10. The intermuscular fish tag of claim 1, wherein the rear portion of the anchor member has a transverse hole for connecting the streamer.
5
11. The intermuscular fish tag of claim 1, wherein the streamer is a flexible tube.
12. The intermuscular fish tag of claim 1, wherein the streamer is connected to the anchor member using monofilament.
10
13. The intermuscular fish tag of claim 1, wherein the streamer carries written indicia of the fish.
14. An intermuscular fish tag comprising:
15 (a) an anchor member having a generally conical head, a rear portion extending from the base of the conical head and at least two barbs flaring outwardly from the base of the conical head,
 the barbs being at an angle to the axis of the conical head which is larger at an end of the barb farthest from the head than at an end of the barb which meets the head,
20 the barbs being flexible enough to bend inward to allow easy insertion of the anchor member in the muscle of the fish,
 resilient enough to bend outward to their original positions once in the muscle of the fish but rigid in preventing bending outward substantially
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further than the original position in order to secure the anchor member firmly, and

5 the anchor member also having an axial channel running through the conical head and rear portion of the anchor member, through which an applicator may be inserted for holding the tag and applying center force to the anchor member in order to puncture the exterior surface of the fish and the muscle of the fish, the axial channel also facilitating withdrawal of the applicator once the anchor member has been inserted in the muscle of the fish, and

10 (b) a streamer connected to the anchor member.

15 15. The intermuscular fish tag of claim 14, wherein the head of the anchor member is frustoconical.

20 16. The intermuscular fish tag of claim 14, wherein the anchor member has sufficient surface area to cause a puncture wound rather than a slit type wound during insertion in the fish to expedite the healing process.

25 17. The intermuscular fish tag of claim 14, wherein the barbs having outside surfaces generally curved to follow the curvature of the circular base of the conical head to facilitate insertion in the fish.

30 18. The intermuscular fish tag of claim 14, wherein the barbs run parallel to the axis of the head at the end of the barb which meets the head, and the end of the barb farthest from the head is at

- 25 -

an angle of about forty five degrees or greater to the axis of the head.

19. The intermuscular fish tag of claim 14, wherein the barbs have an outside surface which is radiused away from the axis of the anchor member, the barbs also having an inside surface which is radiused away from the axis of the anchor member, the outside and inside surfaces meeting at a tapered edge, wherein the distance between the outside and inside surfaces is greater at the end of the barb which meets the head than at the end of the barb farthest from the head so that the barb is flexible bending inward and resilient enough to bend backward to its original position once inside the fish, and rigid enough to prevent bending outward substantially further than the original positions in order to secure the anchor member firmly in the fish.
20. The intermuscular fish tag of claim 19, wherein the barbs have greater mass at the end extending from the head than at the end farthest from the head to provide flexibility bending inward and rigidity for bending outward.
21. The intermuscular fish tag of claim 14, wherein the barbs have a sharp edge for shearing the muscle of the fish to secure the fish tag in the fish.
22. The intermuscular fish tag of claim 14, wherein the anchor member is made from nylon 66.

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23. The intermuscular fish tag of claim 14, wherein the rear portion of the anchor member has a transverse hole for connecting the streamer.
- 5 24. The intermuscular fish tag of claim 14, wherein the streamer is a plastic tube.
25. The intermuscular fish tag of claim 14, wherein the streamer is connected to the anchor member with monofilament.
- 10 26. The intermuscular fish tag of claim 14, wherein the streamer carries written indicia of the fish.
27. An intermuscular fish tag comprising:
 - (a) an intermuscular anchor member having a generally frustoconical head, a rear portion having a transverse hole, and at least two barbs flaring outwardly from the base of the conical head, the head having enough surface area to provide a puncture wound rather than a slit type wound when inserted in the muscle of the fish,
 - 20 the barbs have an outside surface which is radiused away from the axis of the anchor member, the outside surfaces generally curved to follow the curvature of the base of the conical head, the barbs also having an inside surface
 - 25 which is radiused away from the axis of the anchor member, the outside and inside surfaces meeting at a tapered edge, wherein the mass at the end of the barb which meets the head is greater than the mass at the end of the barb farthest from the head, the barb being flexible bending inward and resilient enough to bend outward to its original position

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once inside the fish, but rigid enough to prevent bending outward substantially further than the original position to secure the anchor member firmly in the fish, the tapered edge further securing the anchor member by shearing the muscle of the fish, and

wherein the distance between the inside and outside surfaces is greater at the end of the barb which meets the head than at the end of the barb farthest from the head, and

(b) a streamer connected to the transverse hole of the anchor member.

28. The intermuscular fish tag of claim 27, wherein the barbs initially running parallel to the axis of the conical head and then flaring outwardly from the axis at an angle which increases substantially linearly to about forty five degrees at the end of the barb farthest from the head.

29. The intermuscular fish tag of claim 27, wherein the anchor member further comprises an axial channel running through the conical head and rear portion of the anchor member, through which an applicator may be inserted to generally form a complete cone in combination with the head of the anchor member to puncture the fish to facilitate insertion of the anchor member.

30. An intermuscular fish tag comprising:
(a) an anchor member for securing the tag in the fish, having a hole,
(b) a tube carrying indicia of the fish,
(c) monofilament having first and second ends, the first end being passed through the hole

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in the anchor member and joined with the second end, the two ends being passed through the tube and folded back along the length of the exterior of the tube, and

5 (d) a heat shrinkable material surrounding the tube and the monofilament ends to prevent the first and second ends from coming loose.

31. The intermuscular fish tag of claim 30, wherein the heat shrinkable material is plastic.

10 32. The intermuscular fish tag of claim 30, wherein the heat shrinkable material protects the tube from marine growth which tends to hide, destroy or deteriorate the indicia of the fish carried by the tube.

AMENDED CLAIMS

[received by the International Bureau on 20 February 1992 (20.02.92);
original claims 1-32 replaced by amended claims 1-27 (9 pages)]

1. An intermuscular fish tag comprising:
 - (a) a biologically compatible intermuscular anchor member including a generally conical head having a cylindrical base, a rear portion extending from the base of the conical head, and two molded spring-loaded outside-radius barbs flaring outwardly from the base of the conical head, the radiused barbs being at an angle to an axis which runs parallel to the length of the conical head,
which angle is larger at an end of each of the barbs farthest from the head than at an end of each of the barbs which meets the head;
the radiused barbs each having an inside and outside surface which surfaces are tapered and meet to form a sharp edge at the ends of the barbs farthest from the head for shearing and penetrating musculature of a fish corresponding to radial movement of the barbs;
 - the radiused barbs are flexible enough to bend inward to allow easy insertion of the anchor member through scaly skin and musculature of the fish to a position completely in the musculature, resilient enough to move radially outward to original positions once completely in the musculature of the fish, sharp at the ends of the barbs farthest from the head to shear and penetrate the musculature corresponding to the radial movement of the barbs to their original positions in order to compensate for musculature elasticity, and rigid enough to prevent the barbs from bending outward

substantially further than their original positions once the anchor member is completely in the musculature in order to secure the anchor member firmly in the musculature of the fish to prevent tag shedding; and

5 (b) a streamer connected to the anchor member.

2. The intermuscular fish tag of claim 1, wherein the head of the anchor member is frustoconical.

3. The intermuscular fish tag of claim 1, wherein the head of the anchor member has sufficient surface area to
10 cause a puncture wound rather than a slit type wound during insertion in the fish to expedite healing of the wound to prevent tag shedding.

4. The intermuscular fish tag of claim 1, wherein the outside surfaces of the radiused barbs are curved to follow
15 the curvature of the base of the conical head.

5. The intermuscular fish tag of claim 1, wherein the barbs run parallel to the axis of the head at the end of the barb which meets the head, and the end of the barb farthest from the head is at an angle of about forty five degrees or
20 greater to the axis of the head.

6. The intermuscular fish tag of claim 1, wherein the barbs have greater mass at the end which meets the head than at the end farthest from the head.

7. The intermuscular fish tag of claim 1, wherein the anchor member is made from nylon 6,6.

8. The intermuscular fish tag of claim 1, wherein the rear portion of the anchor member has a transverse hole for
5 connecting the streamer.

9. The intermuscular fish tag of claim 1, wherein the streamer is a flexible tube.

10. The intermuscular fish tag of claim 1, wherein the streamer is connected to the anchor member using
10 monofilament.

11. The intermuscular fish tag of claim 1, wherein the streamer carries written indicia of the fish.

12. The intermuscular fish tag of claim 1, wherein the anchor member also has an axial channel through which a
15 sharp pointed stainless steel applicator is inserted for holding the tag and facilitating easy penetration of the anchor member at any angle using center applied force through the scaly skin and the musculature of the fish, the axial channel also facilitating easy withdrawal of the
20 applicator without the anchor member once the anchor member has been inserted completely in the musculature of the fish.

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13. The intermuscular fish tag of claim 12, wherein the anchor member has a frustoconical head through which the applicator is inserted to form a complete cone in combination with the frustoconical head to facilitate easy 5 insertion of the anchor member into the scaly skin and musculature at any angle using center applied force.

14. A fish tag comprising:

- (a) an anchor member for securing the tag in the fish, the anchor member having a hole,
- 10 (b) a tube carrying indicia of the fish,
- (c) monofilament having first and second ends, the first end being passed through the hole in the anchor member and joined with the second end, the two ends being passed through the tube and folded back along the length 15 of the exterior of the tube, and
- (d) a heat shrinkable material surrounding the tube and the monofilament ends to prevent the first and second ends from coming loose.

15. The fish tag of claim 14, wherein the heat 20 shrinkable material is plastic.

16. The fish tag of claim 14, wherein the heat shrinkable material protects the tube from marine growth which tends to hide, destroy or deteriorate the indicia of the fish carried by the tube.

Please add the following claims:

17. The fish tag of claim 14, wherein a loop is formed by the monofilament between the anchor member and the heat shrinkable material for tissue of the fish to grow through
5 in order to provide a holding mechanism in addition to the anchor member to prevent tag shedding.

18. The fish tag of claim 14, wherein the anchor member is a biologically compatible intermuscular anchor member comprising a conical head having a cylindrical base, a rear portion extending from the base of the conical head, and two molded spring-loaded outside radiused barbs flaring outwardly from the base of the conical head, the radiused barbs originally positioned running parallel to the conical head at an end of each of the barbs nearest the conical head, and radiused outward to an angle, to an axis which runs parallel to the length of the conical head, of about forty-five degrees at an end of each of the barbs farthest from the conical head, the radiused barbs moving inward during insertion and moving radially outward to their original positions once to a position completely in the musculature.
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19. The fish tag of claim 18, wherein the anchor member is made from nylon 6,6.

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20. The fish tag of claim 18, wherein the barbs each have an outside and inside surface, the surfaces are tapered to form a sharp edge for shearing and penetrating musculature of the fish corresponding to radial movement of
5 the barbs to their original positions in order to compensate for musculature elasticity.

21. The fish tag of claim 20, wherein the head is frustoconical.

22. The fish tag of claim 21, wherein the anchor member
10 also includes an axial channel running through the frustoconical head and the rear portion through which a sharp pointed stainless steel applicator is inserted to form a complete cone in combination with the frustoconical head for holding the tag and facilitating easy penetration of the
15 anchor member at any angle using center applied force through scaly skin and musculature of the fish.

23. A tagging system for fish comprising:

(a) biologically compatible intermuscular anchor member including a frustoconical head having a cylindrical base with a diameter, forming a smooth transition with the head, a rear portion having a transverse hole, the rear portion having dimensions which do not exceed the diameter of the base, two molded spring-loaded outside-radius barbs flaring outwardly from the base which are contoured to
25 follow the curvature of the conical head, and an axial

channel running through the frustoconical head and the rear portion;

the radiused barbs running parallel to the conical head at an end of the barbs nearest the conical head, and

5 radiused outward at an angle, to an axis which runs parallel to the length of the conical head, of about forty five degrees at an end of the barbs farthest from the head;

the radiused barbs each having an inside and outside surface, the surfaces have a width of about the diameter of

10 the

base of the conical head, the surfaces are tapered and meet to form a sharp edge at the ends of the barbs farthest from the frustoconical head for shearing the musculature corresponding to radial movement of the barbs;

15 the radiused barbs are flexible enough to bend inward to allow easy insertion of the anchor member through scaly skin and musculature of a fish to a position completely in the musculature, resilient enough to move radially outward to original positions once completely in the musculature, sharp

20 at the ends of the barbs farthest from the frustoconical head to shear and penetrate the musculature of the fish corresponding to the radial movement of the barbs to their original positions in order to compensate for musculature elasticity, and rigid enough to prevent the barbs from

25 bending outward substantially further than their original positions once completely in the musculature in order to secure the anchor member firmly in the musculature of the fish to prevent tag shedding;

(b) a streamer connected to the anchor member;
(c) a sharp pointed stainless steel applicator having first and second ends, the first end of the applicator being inserted through the axial channel for holding the anchor member, the first end of the applicator being tapered to a sharp point to form a complete cone with the frustoconical head providing easy insertion of the anchor member at any angle and providing center force for insertion through the scaly skin and completely 10 into the musculature of the fish.

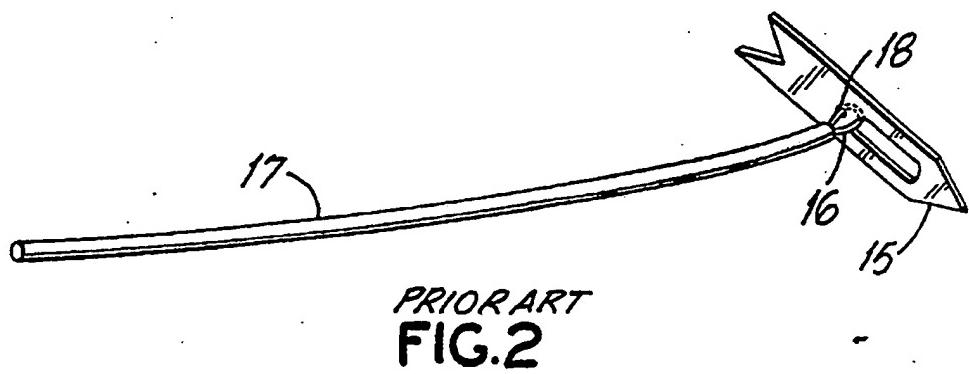
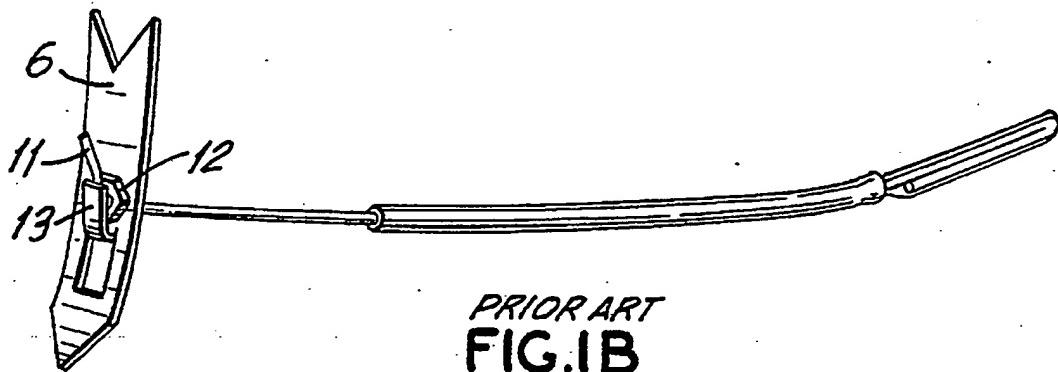
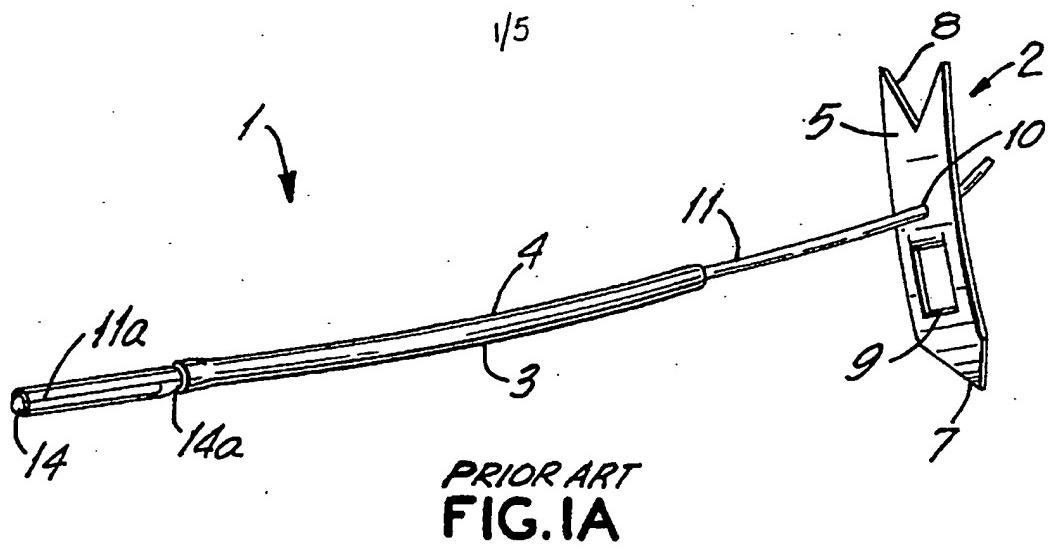
24. The tagging system of claim 23, wherein the second end of the applicator has a diameter which is slightly larger than a diameter of the first end so that the anchor member is positioned on the first end at a point where the 15 two ends meet and is held in place to form a complete cone with the first end.

25. The tagging system of claim 24, wherein the second end of the applicator is mounted to a stop system, the stop system being mounted to a tag insertion shaft.

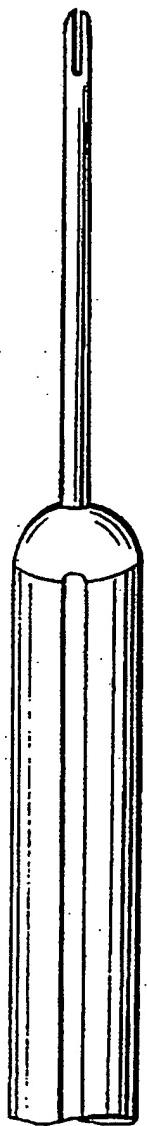
20 26. The tagging system of claim 25, wherein the stop system is made from nylon.

27. The fish tag of claim 26, wherein the fish is a billfish and the stop system is positioned so that the anchor member is inserted about two inches into the fish to

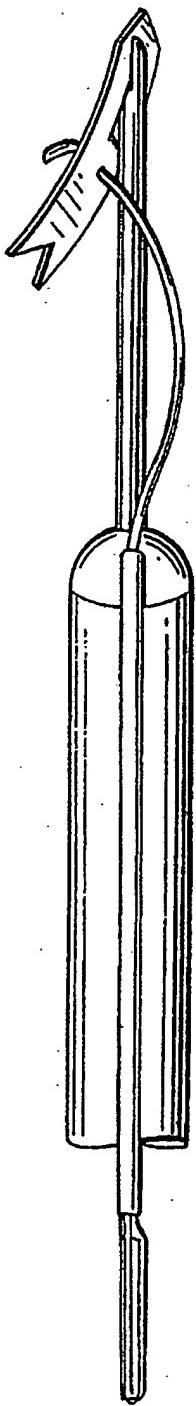
assure the anchor member is at the position completely in
the musculature.



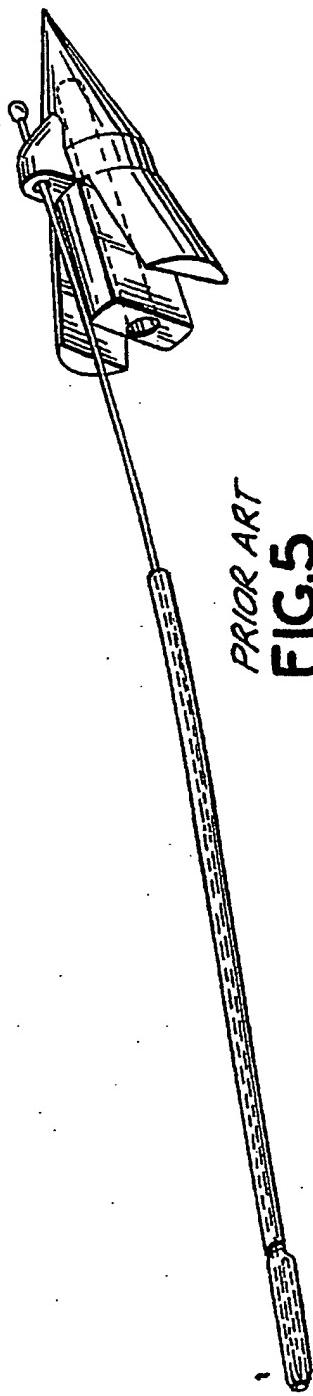
215



PRIOR ART
FIG. 3

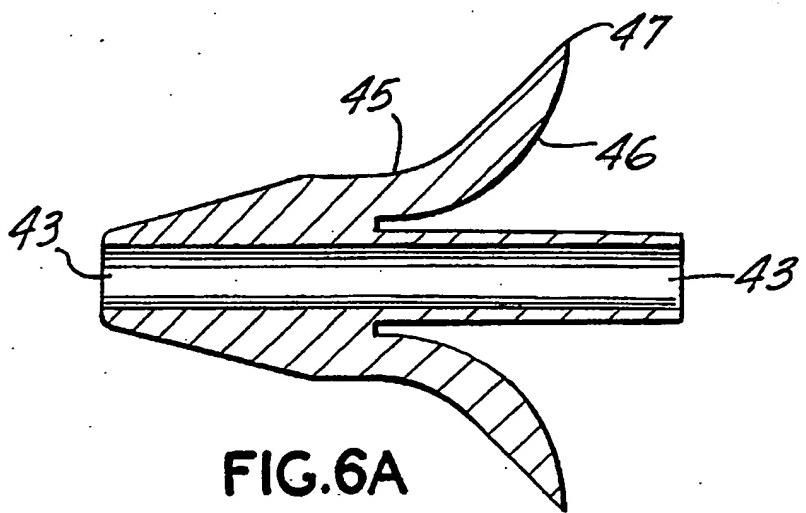
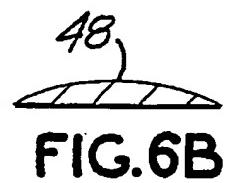
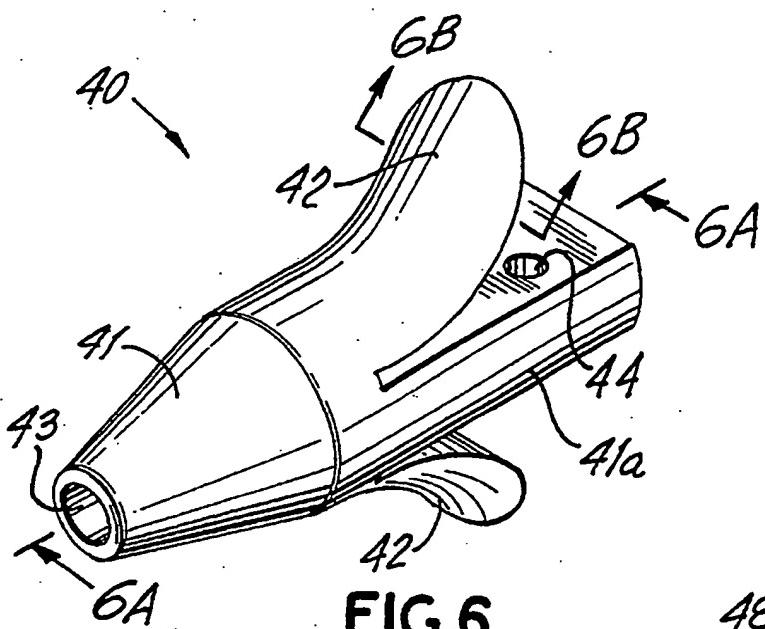


PRIOR ART
FIG. 4



PRIOR ART
FIG. 5

315



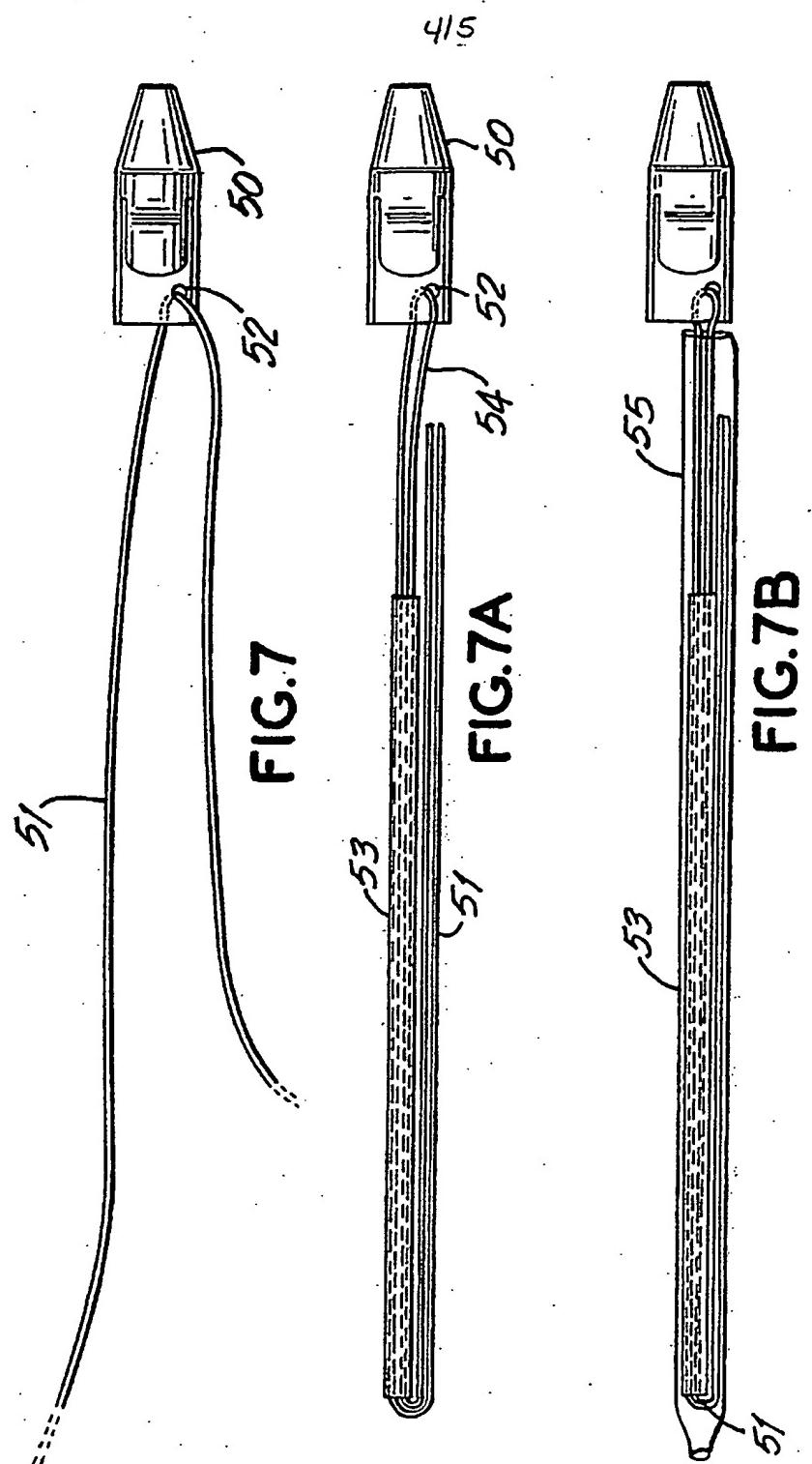


FIG.8B

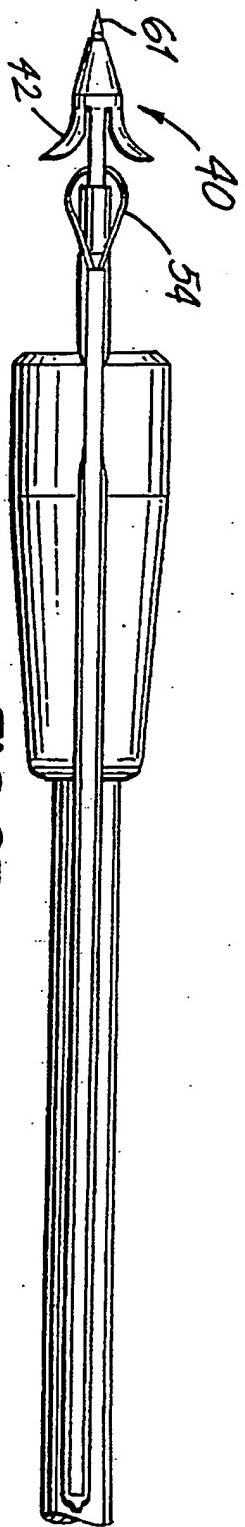


FIG.8A

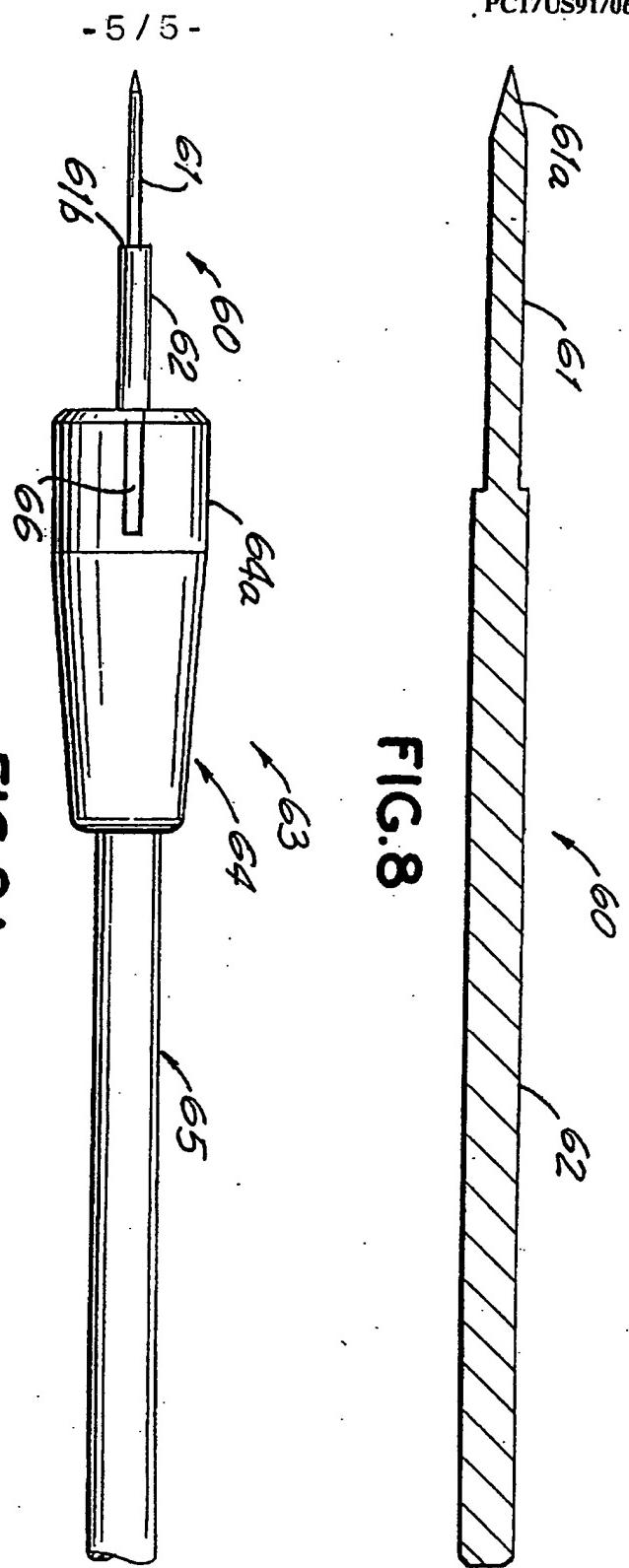


FIG.8

A FISH TAG

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Publication date: 1992-03-19
Inventor(s): LOPEZ ALLYN M (US); PRINCE ERIC D (US)
Applicant(s): LOPEZ ALLYN M (US); PRINCE ERIC D (US)
Requested Patent: WO9204702
Application Number: WO1991US06224 19910830
Priority Number(s): US19900575236 19900830
IPC Classification: G09F3/00
EC Classification: G09F3/00, A01K11/00, A01K61/00A
Equivalents: AU8620391
Cited patent(s): US3999478; US1347868; US4790090; US4920670

Abstract

An intermuscular fish tag and tagging system is provided; the fish tag including an anchor member (40) having a frustoconical head (41), an axial channel (43) running through the head, and two barbs (42) flaring outwardly from the base of the head. The barbs initially run parallel to the axis of the head and then flare outwardly to an angle of forty-five degrees at the end of barb farthest from the head. Each barb has an inside (46) and outside (45) surface which meet at a sharp tapered edge (47), providing greater mass at the end of the barb that meets the head than the end of the barb farthest from the head. Such a configuration allows for resiliency in the barbs, so that they bend going in the fish and return to their original positions once inside the muscle of the fish. An application device (60), having an applicator with a shaft tapered to a sharp point (612) is passed through the axial channel to form a complete cone with the head of the anchor member to puncture the fish.

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